AbstractID: 2068 Title: Bone Densitometry Using X-Ray Spectra

An inherent limitation of DEXA is the poly-energetic nature of the X-rays used to measure BMD. Hardening of the two non-mono-energetic beams in DEXA is known to produce significant systematic errors.

In this study the complete energy spectrum of an X-ray beam transmitted through two layers of different materials was utilized to calculate the mass per unit cross-sectional area (areal density) of each layer. Test objects, constructed from aluminum and Plexiglas were formulated to simulate cortical bone and soft tissue respectively. Solid state HPGe, CZT and NaI detectors were used. Areal densities were obtained from spectra using two methods, a system of equations for two spectral regions or a simple fit of the entire spectrum.

Our results suggest that two narrow regions of the spectrum that can be almost arbitrarily selected to determine the areal densities of two different materials using a system of two equations. The use of narrow spectral regions has the advantage of limiting the effects of beam hardening. Another promising analysis technique is a simple fit of the entire spectrum, where unknown areal densities of the two target materials are parameters determined by a numerical fit. This technique gives accurate results with lower statistical errors, and significantly reduced beam hardening effects.